

BOOK
OF
PROCEEDINGS

WASTES

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PREPARATION AND USE OF SLAG FROM THE INCINERATION OF MUNICIPAL SOLID WASTE AS A PARTIAL SUBSTITUTE FOR PORTLAND CEMENT

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ABSTRACT

In the development of the study and interpretation of the new approaches on complementary cementitious materials, we have been developing, in a first step, a study of comparative analysis of the physical, chemical and mechanical characteristics of the ordinary cement CEM I 42.5 R produced by CIMPOR [1]. We will use matured and unripened slag resulting from the incineration of municipal solid waste processed by LIPOR [2]. In this laboratory study, the materials were first submitted to a differentiated grinding process in a ball mill, and subsequently used to the tests of particle size analysis by laser diffraction in the range of particles between 0.04 μm to 2000 μm . This was followed by fineness determination tests according to NP EN 196-6 and subsequently manufactured various types of hybrid mortars, (with a cement/slag ratio=4) and moulding of the respective specimens. Finally, they were all submitted to mechanical compressive strength tests at 7, 28 and 90 days, according to NP EN 196-1. Finally, the results were analyzed and discussed.

Keywords: Waste, Incineration, Slags, Compressive Strength.

INTRODUCTION

In this brief characterization of the slags we intend to analyze in the laboratory their physical, chemical and mechanical behavior that allows us to study in a comparative way their results, whereas, for hybrid cements, the literature states that under certain conditions and mixtures, values of 46 Mpa at 28 days, in stages of alkaline activation of the slags. [3]

As an organizational method, we subdivided the study into three stages: I-Preparation of materials; II-Laboratory tests ; III-Analysis and comparison of results for conclusion.

MATERIALS

Material (a) Cement CEM I 42.5 R produced by CIMPOR, unmatured slag material designated as (b) Slag-NMat-LL, matured slag material designated as (c) Slag-Mat 1n25% and (d) Slag-Mat1n50%, due to the fact that the latter two are subjected to a grinding process during one night (1n) in a mill of 23 balls with a total weight of 1657.8 grams, being (c) with, 25% of the weight of the spheres, 414.45 grams and (d) with, 50% of the weight of the spheres, 828.9 grams.

Table 1 Characteristics of cement CEM I 42.5 R [4]

Properties		
Chemical	Physical	Mechanical
Loss to fire (LF) ≤ 5,0%	Prey start time ≥ 60 mm	Compressive Strength
Insoluble residue (LR) ≤ 5,0%	Expandability ≤ 10 mm	Minimum values
Sulphate content (SO ₃) ≤ 4,0%	.	To 2 Days 20,0 MPa
Chloride content (CC) ≤ 0,10%	.	To 28 Days 42,5 MPa

Table 2 Characteristics of cement (Author)

Reference	Material	Cem (gr)	Wt. (gr)	Mat (gr)	Sand (gr)
Cement-Ctr	CEM I 42.5 R	450	225	-	1350
Slag-NMatLL	Slag n/maturad	360	225	90	1350
Slag-Mat1n25%	Matured slag	360	225	90	1350
Slag-Mat1n50%	Matured slag	360	225	90	1350

RESULTS

Table 3 Characteristics of cement (Author)

Reference	Material	D10 (µm)	D50 (µm)	D90 (µm)	Surface Specific(cm ² /g)
Cement-Ctr	CEM I 42.5 R	1.141	11.71	32.87	28026
Slag-NMatLL	N/matured slag	2.454	27.6	148.3	8989
Slag-Mat1n25%	Matured slag	1.388	13.13	66.67	15765
Slag-Mat1n50%	Matured slag	1.417	10.82	56.34	16057

Table 4 Characteristics of cement (Author)

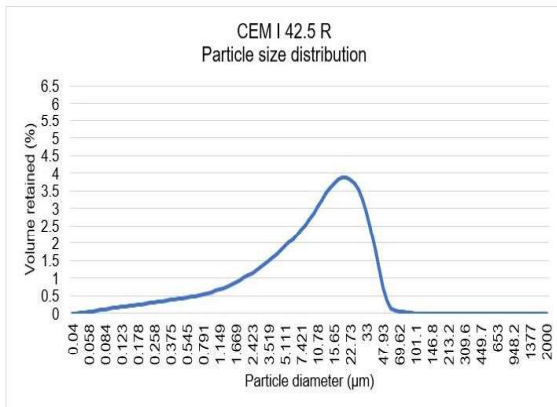
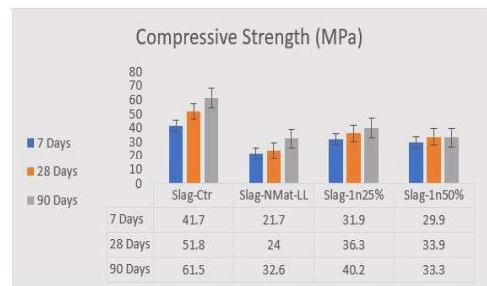


Figure 1: Particle size distribution CEM I(Author)

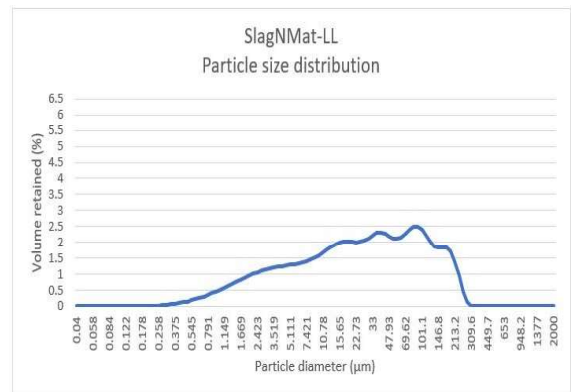


Figure 2: Particle size distributim SlagNMat-LL(Author)

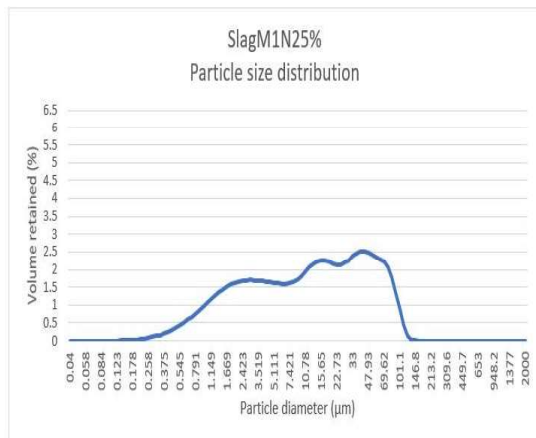


Figure 3: Particle size distribution SlagM1N25%(Author)

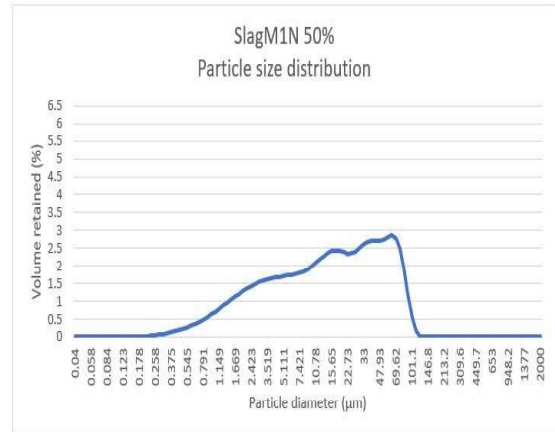


Figure 4 Particle size distribution SlagM1N50%(Author)

ANALYSIS OF THE RESULTS

Evaluation of the influence of these indicators on the results of compressive strength.

I-Characteristic Diameter Variation: D10

(D10 from CEM I 42.5 R=1.141 μ m) < (D10 from SlagMat1n25%=1.388) < (D10 from SlagMat1n50%=1.417 μ m) < (D10 from SlagNMLL=2.454 μ m)

II-Median Diameter Variation: D50

(D50 from SlagMat1n50%=10.82 μ m) < (D50 from CEM I 42.5 R=11.71 μ m) < (D50 from SlagMat1n25% =13.13 μ m) < (D50 from SlagNMLL=27.60 μ m)

III-Characteristic Diameter Variation: D90

(D90 from CEM I 42.5 R=32.87 μ m) < (D90 from SlagMat1n50%=56.34 μ m) < (D90 from SlagMat1n25%=66.67 μ m) < (D90 from SlagNMLL=148.30 μ m)

IV-Specific Surface Variation:SS

(SS from CEM I 42.5 R=28026 c²/g) > (SS from SlagMat1n50%=16057 c²/g) > (SS from SlagMat1n25%=15765 c²/g) > (SS from SlagNMLL=8989 c²/g)

V-Variation of Compressive Strength MPa at 28 days

CEM I 42.5 R = 51.8 ; SlagNMLL= 24.0 ; SlagMat1n25% =36.3 ; SlagMat1n50%=33.9

CONCLUSION

Although with a reduced number of observations, we did not find any correlation between the results obtained in the particle size analysis and the results of compressive strength, for which, we will continue with this line of investigation in future more in-depth and continued studies.

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